

REMARKS

This application as been amended in a manner that is believed to place it in condition for allowance at the time of the next Official Action.

Claims 1-21 are pending in the application. Claims 1-10 have been amended to address formal matters. Claim 11 was canceled previously. Claims 12-21 have been added. Support for claims 12-21 may be found in the original claims throughout the specification.

In the outstand Official Action, claims 1-10 were rejected under 35 U.S.C. § 103(a) alleging as being unpatentable over TREVES et al., DROUX et al., and KIRK-OTHMER. This rejection is respectfully traversed.

TREVES relates to the study of organic nitrates that form via a photodegradation of hydrocarbons in the troposphere in the presence of NO and NO₂. TREVES. indicates this process is an important area of study as it competes with the chemical cycle leading to ozone production. However, although TREVES does discuss synthetic methods to produce certain nitrates, TREVES is not interested in obtaining a process for the separation of 1,4-butanediol mononitrate from a solution of 1,4-butanediol dinitrate and of 1,4-butanediol in a water immiscible organic solvent. Indeed, this is acknowledged at the bottom of Page 2 of the outstanding Official Action.

In an effort to remedy the deficiencies of TREVES for reference purposes, the Official Action cites to DROUX in the Encyclopedia of Chemical Technology.

DROUX is cited for the proposition that the publication discloses nitrooxy alcohols are produced by nitrating the corresponding diol with nitric acid in chloroform or trichloromethane, then separating the nitrooxy alcohol with an extraction of water and an organic chlorinated solvent in two consecutive extraction columns. The Encyclopedia of Chemical Technology is cited for the proposition that such extractions can be arranged in a counter-current manner.

However, applicants respectfully submit that a skilled person aimed at finding a method for the preparation of pure butanediol mononitrate (BDMN) would not have substituted the flash chromatography taught by DROUX with the counter-current liquid-liquid extraction suggested by TREVES and KIRK-OTHMER. TREVES and KIRK-OTHMER do not actually teach a purification process that would provide sufficient motivation to combine and modify the publications to obtain the claimed invention.

Indeed, the technical problem underlying the present invention is to provide a separation/purification process for the preparation of pure BDMN, avoiding crystallization and distillation steps that can lead to explosion. In this regard, it is believed that the inventors have discovered for the first time a solution to this technical problem lies in one or more

two-steps liquid-liquid extraction cycles, the first one with water and the second one with an organic solvent.

DROUX does not teach to separate and purify BDMN. Rather, DROUX teaches to prepare a mixture of diols which requires subsequent purification, namely by column chromatography. In other words, what is disclosed in DROUX is a common method for isolating a product from a reaction mixture, not a purification process (see Preparation 4, step B, on page 12). After quenching the chloroform reaction mixture with water, the aqueous phase is re-extracted with chloroform in order to recover all the organic compounds. This is confirmed that the weight of the product (4.26 g) obtained after complete evaporation of the solvent ("On .. séche puis amène à sec sous pression réduite") amounts to a yield higher than 100%. It is believed that the reason for such a yield is that the product recovered at the end of the work up is a mixture of mono-nitrate derivative (4- [(nitro) oxy] methyl] 2,2, diméthyl-cyclopropane-1-methanol and of the corresponding di-nitrate derivative. Therefore, the addition of water at the end of the reaction is only utilized to wash out the inorganic acidic compounds (nitric and acetic acids) generated as by products, while chloroform is added to recover all the mono-nitrate and di-nitrate end products. Unlike step b) of the claimed process, the extraction of DROUX would not allow one to separate the mono-nitrate compound (BDMN) from the unreacted diol-compound (BD),

thus recovering pure BDMN. Indeed, DROUX teaches that chromatography is necessary to purify the mono-nitro derivative). In this regard, DROUX does not suggest the use of water-immiscible organic solvents to separate a mono-nitrate compound from the unreacted diol-compound as claimed.

It will be appreciated that in the process of the invention, the first extraction of the organic mixture with water enables one to separate BD and BDMN (which are soluble in water) from BDDN, which remains in the organic layer, while the second extraction from the aqueous medium, performed with a water-immiscible organic solvent, enables one to separate BDMN from BD.

As stated above, the process of the invention provides purified BDMN. The final organic solution may preferably contain BDMN with purity from about 99.5% to about 99.9%, in amounts from about 5% to about 8% w/w. Moreover, as stated on page 8 of the description, the solution is substantially free from BDDN, whose amount is below 0.2%. BDDN is even more explosive than BDMN. Therefore, keeping its levels as low as possible represents a further advantage of the invention.

In view of these differences, it is respectfully submitted that DROUX fails to remedy the deficiencies of TREVES and KIRK-OTHMER for reference purposes.

The Supreme Court recently addressed the issue of obviousness in *KSR International Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 167 L.Ed.2d 705 (2007). While the KSR Court rejected a

rigid application of the teaching, suggestion, or motivation ("TSM") test in an obviousness inquiry, the Court acknowledged the importance of identifying "a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does" in an obviousness determination. *KSR*, 127 S.Ct. at 1731.

Moreover, the Court indicated that there is "no necessary inconsistency between the idea underlying the TSM test and the *Graham* analysis." *Id.* As long as the test is not applied as a "rigid and mandatory" formula, that test can provide "helpful insight" to an obviousness inquiry. *Id.*

As one skilled in the art would lack a reason to combine and modify the publication in a manner to obtain the claimed invention, applicants believe that the rejection is improper as a matter of law and ask that it be withdrawn.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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